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# Simulation of disease transmission in pig production on farm level using a cellular automaton

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## 1 - Introduction

- Outbreak of a notifiable disease triggers strict control measures (EU legislation).
- Culling and trade restrictions cause high mortality and economic losses.
- Cellular automaton to simulate disease spread between animals on a pig farm, accounting for varying contagiousness levels.
- **Structural farm elements** might function as local barriers, providing a more detailed representation of disease dynamics.

#### cellular automaton

- considers local effects
- spatial distribution
- population can be segmented
- transmission within farm and between animals occurs with varying probabilities



## 3 - Results



#### 2 - Fundamentals

![](_page_0_Figure_19.jpeg)

Fig. 1: Farm setup with 432 animals, housed in pens of 12 across six compartments, highlighting the structural elements that influence transmission events (aisle, pen wall and wall) and the animal characteristics (not infected, infected and detected).

![](_page_0_Figure_21.jpeg)

![](_page_0_Figure_22.jpeg)

iteration

## high contagiousness

![](_page_0_Figure_25.jpeg)

Fig. 3: Spread of infection in a 432-animal fattening house after 40 iterations (B), modeled using a cellular automaton illustrating how structural elements (A), including pen walls, barriers, and transmission obstacles (with 100% blocking efficiency), help limit the spread of infection, despite varying levels of contagiousness.

#### 4 - Conclusion

A **cellular automaton** simulates disease transmission considering 

Fig. 2: Starting with a single infected animal (A) infecting neighboring animals with varying probabilities (B).

- local structures and different scalable transmission obstacles .
- > Highlighting different control measures helps to identify the most effective strategies.
- > Next step: adapt the model to a real disease (e. g. African Swine) Fever).
- > Explore ways to refine control measures, protect animal welfare and prevent economic losses.

![](_page_0_Picture_34.jpeg)

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